MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

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INTRODUCTION.

The REVIEW for March, 1895, is based on reports from 3,209 stations occupied by regular and voluntary observers. These reports are classified as follows: 149 reports from Weather Bureau stations; 36 reports from U. S. Army post surgeons; 2,379 monthly reports from State Weather Service and voluntary observers; 31 reports from Canadian stations; 68 reports through the Southern Pacific Railway Company; 528 marine reports through the cooperation of the Hydrographic Office, Navy Department, and New York Herald Weather Service; monthly reports from 18 U. S. Life-Saving stations; monthly reports from local services established in all States and Territories; and international simultaneous observations. Trustworthy newspaper extracts and special reports have also been used.

The WEATHER REVIEW for this month has been prepared under the general editorial supervision of Prof. Cleveland Abbe. Unless otherwise specifically noted, the text is written by the Editor, but the statistical tables are furnished by the Division of Records and Meteorological Data, in charge of Mr. A. J. Henry, chief of that division.

CHARACTERISTICS OF THE WEATHER FOR MARCH, 1895.

The mean temperature throughout the United States was not remarkable for any extreme values, but the extreme temperatures were the highest on record in the interior and the lowest on record on the coast of Washington, Oregon, and California. The accumulated temperatures continue to show a general deficit. The rainfall was deficient over the extreme Northern and Southern States and the Atlantic coast, but was in excess over the Central States. The accumulated precipitation continued to show a deficit from the Middle States and New England west and southwest to the Rocky Mountain plateau.

ATMOSPHERIC PRESSURE.

[*In inches and hundredths.*]

The distribution of mean atmospheric pressure reduced to sea level, as shown by mercurial barometers not reduced to standard gravity and as determined from observations taken daily at 8 a. m. and 8 p. m. (seventy-fifth meridian time), is shown by isobars on Chart II. That portion of the reduction to standard gravity that depends on latitude is shown by the numbers printed on the right-hand border.

The *mean pressures* during the current month were highest in the southern and central portions of the United States; the highest was 30.14, Tampa and Titusville. The lowest mean pressures were in Canada, the northern portion of the United States, and along the coast of Washington and Oregon; the lowest was 29.69, St. Johns.

As compared with the normal for March, the mean pressure for the current month was decidedly in excess in the Lake region, along the Atlantic coast from New Hampshire to the extreme southern end of Florida, along the Gulf coast and in the Mississippi Valley as far north as St. Paul, except in Mississippi and a portion of Louisiana; the greatest excess was Lander, 0.07. Pressure was deficient in Maine and Canada, in the British Possessions, and along the northern portion of the United States to the Pacific coast and through Washington, Oregon, and California to Yuma, also in Mississippi and part of Louisiana; the greatest deficit was 0.14, St. Johns.

As compared with the preceding month of February, the pressures reduced to sea level show a rise in Canada, New England, New York, New Jersey, and the Lake region as far as Sault Ste. Marie. The maximum rise was Yarmouth, 0.13. Throughout the rest of the country pressure fell. The maximum falls were: Miles City, 0.27; Medicine Hat and Idaho Falls, 0.26; Oklahoma, 0.25.

AREAS OF HIGH PRESSURE.

The tracks of the centers of areas of high pressure are shown on Chart IV, which also gives the maximum pressure at the center at each date.

Of these areas the most remarkable were the following:

I.—This appeared on the 1st, covering the Rocky Mountain plateau region, where the center of highest pressure soon disappeared. At that time its front extended from southern Texas to the Upper Lake region with strong, cold, northwesterly winds over the entire interval. As this front moved eastward to the Appalachians, with rain or snow from Texas to the Lake region, a trough of low pressure developed at the southern extremity in Alabama and moved eastward as low No. II, while another developed at the northern extremity and moved northeastward as low No. I. The heavier rains and stronger winds attended the center of the southern depression.

VII.—This first appeared in Alberta and Saskatchewan on the 11th, and was central in Nebraska on the 14th. While pressure was high on the eastern slope of the Rocky Mountains it was low on the western slope, and continued low from the 10th to the 14th at Yuma. We may, therefore, consider that a trough prevailed from Mexico northwest beyond British Columbia, while the two high areas over the western Pacific and the central portion of North America pressed toward each other to fill up this deficiency and brought westerly winds and rains to the Pacific coast but easterly winds and snow to the eastern slope of the Rocky Mountains. Within such a long trough of low pressure, or meiobar, numerous whirls are formed between the contending winds. As before explained in connection with the "northers" of the Gulf of Mexico, so also in this case throughout the Rocky Mountain plateau region, whenever such whirls are anticyclonic they are short-lived, but when they are cyclonic and properly supplied with moist air they develop into disturbances of larger size and longer duration, and this generally occurs at the southern end of the meiobar. In the present case a series of special but minor depressions developed over the Rocky Mountain plateau during the 10th, 11th, 12th, and 13th, until finally, on the 14th, at the southeastern end of the general depression, low No. XIII was formed on the coast of Texas and moved rapidly northeastward, reaching the coast of Nova Scotia by the 16th, p. m.

VIII.—This began on the 18th in Manitoba and ended on the 24th on the south Atlantic coast. During the greater part of its course it presented the aspect of a ridge of high pressure, trending northeast and southwest, and, therefore, in the first part of its career crossing the Rocky Mountain region, but in the latter part parallel to the Appalachian range. The area covered by the daily weather map is not large enough to show the relation of this area of high pressure to distant areas, but we may call attention to some features. There was, on the 18th, a general flow of air southeastward from Manitoba and Hudson Bay to the middle Atlantic and the New Brunswick coast following in the rear of the storm that was then central over the Gulf of St. Lawrence. A second extensive storm was also at that time approaching British Columbia from the Pacific and a slight depression existed in Texas. Therefore, high area No. VIII may have been due to an outflow of cold air from the Hudson Bay region toward these regions of low pressure, in which case the high areas moved southeast and the low areas northeast, as if independent of each other. On the other hand, the system of three lows attending this high area may be considered as forming with it one system of depressions and elevations whose motions resemble the result of a system of waves moving northeastward and interfering with another system moving southeastward; this may, however, be only a superficial resemblance. On the 23d, a. m., this high area was central in Pennsylvania, and temperatures of 38° to 42°, with light frosts, were reported from North and South Carolina, northern Georgia, and eastern Tennessee.

AREAS OF LOW PRESSURE.

The tracks of the centers of areas of low pressure are shown on Chart I, which also gives the minimum pressure at the center for each date.

The most interesting of these areas, considered as storms, are the following:

IV.—This developed rapidly on the 2d and 3d in front of high area No. II, which was then central over the Rocky Mountain plateau. It passed southeast to Missouri and thence northeast to Ohio, where it was central on the 4th, a. m. High winds and heavy snows prevailed over the Lake region, and subsequently over New England, as the storm center passed rapidly northeast to the Gulf of St. Lawrence.

VI.—This appeared first in Saskatchewan, and by the 8th, a. m., was central over Lake Huron, with heavy snow and high winds over the Upper Lakes. By the 9th, a. m., it had apparently broken up in that region, but was followed by a low off the middle Atlantic coast, which had undoubtedly begun its development on the 8th in North Carolina and West Virginia, where high winds with snow or rain had prevailed from Atlanta northward. This is the ordinary case of the transfer of a cyclone from the west to the east side of the Appalachians; the original storm dies away on the west side while the new one is springing up on the east side south or southeast of the former. There is always a tendency for such a transfer to occur. Minor whirls are almost invariably formed on the east slope and at the southern end of the barometric trough, and if circumstances are favorable these increase in importance while the original dies away. The process is precisely similar to what happens on a very much larger scale throughout the Rocky Mountain slope and plateau. In the latter case, owing doubtless to the great height of the mountains and the dryness of the air on the eastern slope, cyclonic storms are entirely broken up as such on the western slope, and if within the resulting trough of low pressure there should be formed a new storm center it will be far to the south or southeast of the original storm track, and will be a feeble depression, notwithstanding the strong winds, until it reaches

MOVEMENT OF CENTERS.

The following table shows the date and location of the center at the first and last appearance of each area of high or low pressure on the U. S. weather maps during the month, together with the average daily and hourly velocities. The monthly averages will differ according as we consider each path as a distinct unit, or give equal weight to each day of observation; in the first case the monthly average is taken by paths, in the latter case by days:

Movement of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	1, a. m.	43	111	2, p. m.	29	101	1,150	1.5	767	32.0
II	2, p. m.	52	114	6, a. m.	36	74	2,900	3.5	829	34.5
II*a*	3, a. m.	53	113	3, p. m.	43	119	500	0.5	.....	.....
III	4, a. m.	52	122	6, a. m.	38	91	1,000	2.0	500	20.8
IV	6, a. m.	55	107	.....	.....	.....	.....	.....	.....	.....
V	6, p. m.	42	113	10, p. m.	31	80	2,400	4.0	600	25.0
VI	9, a. m.	55	113	12, a. m.	45	70	2,600	3.0	867	36.1
VII	11, a. m.	53	104	18, p. m.	33	78	2,500	7.5	333	13.9
VIII	18, a. m.	55	103	24, p. m.	32	78	2,700	6.5	415	17.3
IX	21, p. m.	35	121	24, a. m.	40	119	1,400	3.5	560	23.3
X	24, p. m.	50	115	30, p. m.	28	79	3,600	6.0	600	25.0
XI	27, a. m.	50	105	29, a. m.	38	75	2,100	2.0	1,050	43.7
XII	29, a. m.	42	121	31, p. m.	42	107	1,300	2.5	520	21.7
Sums	.....	.....	.....	.....	.....	.....	24,150	41.5	7,041	.....
Mean of 11 paths	.....	.....	.....	.....	.....	.....	.....	.....	640	26.7
Mean of 41.5 days	.....	.....	.....	.....	.....	.....	.....	.....	582	24.3
Low areas.										
I	1, a. m.	44	78	3, a. m.	49	62	850	1.0	850	35.4
II	1, a. m.	34	90	3, a. m.	35	74	1,150	2.0	575	24.0
III	1, p. m.	52	98	4, a. m.	49	53	2,100	2.5	840	35.0
IV	2, a. m.	47	108	5, a. m.	47	62	2,800	3.0	933	38.9
V	3, p. m.	54	113	4, p. m.	42	96	1,110	1.0	1,100	45.8
VI	5, p. m.	53	103	10, a. m.	48	52	3,450	4.5	767	32.0
VII	6, p. m.	28	101	7, p. m.	30	95	400	1.0	400	16.7
VIII	8, a. m.	53	109	10, a. m.	42	80	1,850	2.0	925	38.5
IX	10, a. m.	31	99	11, p. m.	32	93	450	1.5	300	12.5
X	11, a. m.	44	110	13, a. m.	33	95	1,200	2.0	600	25.0
XI	12, a. m.	43	119	13, p. m.	35	114	850	1.5	567	23.6
XII	13, a. m.	37	84	15, a. m.	48	56	1,700	2.0	850	35.4
XIII	14, a. m.	28	98	16, p. m.	46	58	2,450	2.5	980	40.8
XIV	17, p. m.	49	62	18, p. m.	51	62	500	1.0	500	20.8
XV	18, p. m.	37	102	21, a. m.	36	73	1,700	2.5	680	28.3
XVI	18, p. m.	51	124	26, p. m.	52	64	3,800	8.0	475	19.4
XVII	25, p. m.	54	115	29, a. m.	46	59	2,850	3.5	814	33.9
XVIII	26, p. m.	48	128	31, p. m.	37	92	3,000	5.0	600	25.0
Sums	.....	.....	.....	.....	.....	.....	32,200	46.5	12,756	.....
Mean of 18 paths	.....	.....	.....	.....	.....	.....	.....	.....	709	29.5
Mean of 46.5 days	.....	.....	.....	.....	.....	.....	.....	.....	693	28.9

the Mississippi River. This transfer of a cyclonic center across a mountain range produces the southerly curvature in the average storm track of cyclones crossing the North American Continent. The extreme southern limit reached by any track depends upon the dryness and the pressure of the air in the rear, and the turning point is usually found in the neighborhood of Lake Superior, or else in Missouri, or, even, in Texas.

XII.—This began on the 13th in eastern Kentucky and moved rapidly northeastward, reaching Halifax on the 14th, p. m., having been followed by severe northwest winds on the Atlantic coast. This was another illustration of the rapid development of small areas on the east side of the Appalachians while a high area and cold weather prevails on the west side.

XV.—This began on the 18th, a. m., when a slight depression existed in Kansas, with a high area far to the northward. The low moved southward and then east, passing Arkansas on the 19th, p. m., Tennessee on the 20th, a. m., and was found off the North Carolina coast on the 21st, a. m. Numerous heavy local rains attended this storm, and high northwest winds, followed by frosts, prevailed in the rear.

XVI.—This storm moved from the Pacific Ocean eastward into British Columbia on the 18th, 19th, and 20th. Gales, with heavy rains, prevailed in the western part of Oregon and Washington. By the 22d, a. m., the low center was in Alberta, although rain and snow continued in Washington and Oregon. During the 23d the center passed over Manitoba and on the 24th, p. m., was central on the northern border of Lake Superior, while southwest gales prevailed over the greater part of the Lake region, followed by northwest gales and snow on the 25th. This was the southernmost point in its path, and it turned northeastward on the morning of the 25th, disappearing on the 26th in Labrador.

XVII.—This area moved from Alberta to the Lower Lake region without any specially marked feature, but on the 27th, p. m., the northwest gales over Lake Huron on its western side had a temperature near the freezing point, while the southwest winds over the middle Atlantic States and Lower Lakes had temperatures of 50° or 60°, and light rain or snow had begun to fall at the region where these contrasted winds were mixing. On the 28th, a. m., the storm center was a little east of Boston, the minimum pressure at the center having fallen about 0.30 inch, heavy northwest gales were prevailing over the middle Atlantic States and heavy snow from Vermont to the coast of Maine. The center now turned northward, passing along the coast of Nova Scotia and over Newfoundland as a severe hurricane. The lowest pressure recorded was 28.78 at Sydney, C. B. I.

XVIII.—This storm, like the preceding, No. XVI, also moved northeastward toward Vancouver Island, and by the 27th, p. m., was central in British Columbia. By the 28th, p. m., the trough of low pressure extended from Alberta to Nebraska, being now on the east side of the Rocky Mountains, and the 29th, a. m., this had, as usual, closed up into a central depression representing the southern end in South Dakota. The southward movement continued until the end of the month, and by the 31st, p. m., the center was in Missouri.

NORTH ATLANTIC METEOROLOGY.

Ice.—The following table shows the southern and eastern limits of the region within which icebergs or field ice were reported for March during the last 13 years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Long. W.	Month.	Lat. N.	Long. W.
	° ′	° ′		° ′	° ′
March, 1882	42 20	50 00	March, 1882	46 30	46 00
March, 1883	41 46	49 48	March, 1883	48 40	43 03
March, 1884	41 20	54 06	March, 1884	45 00	40 15
March, 1885	40 55	49 04	March, 1885	45 57	43 15
March, 1886	40 20	49 02	March, 1886	47 20	44 40
March, 1887	41 00	49 07	March, 1887	45 31	42 56
March, 1888	42 30	50 37	March, 1888	47 23	46 56
March, 1889	44 20	53 00	March, 1889	44 20	53 00
March, 1890	41 01	50 54	March, 1890	46 40	39 50
March, 1891	42 25	50 30	March, 1891	49 00	42 44
March, 1892	43 58	48 15	March, 1892	43 58	48 15
March, 1893	44 35	50 13	March, 1893	45 55	46 56
March, 1894	40 20	49 36	March, 1894	46 35	42 30
March, 1895	44 43	57 15	March, 1895	44 51	48 38
Mean	42 04	50 10	Mean	46 15	45 00

The limits of the region within which icebergs or field ice were reported for March, 1895, are shown on Chart I by crosses. The southernmost ice reported, a large field of ice noted on the 25th, was about 2½° north of the average southern limit, and the easternmost ice observed, a berg of moderate size noted on the 31st in the position given in the table, was about 4¼° west of the average eastern limit of ice for March.

Ice was reported on four dates during the current month. A great deal of slush ice, closely packed about half the time, was encountered near the coasts of Newfoundland; but the ice was thin as compared with former years. Much heavy ice was encountered in the Gulf of St. Lawrence.

Fog.—The limits of fog belts west of the fortieth meridian, as reported by shipmasters, are shown on Chart I by dotted shading. East of the fifty-fifth meridian fog was reported on 9 dates; between the fifty-fifth and sixty-fifth meridians on 5 dates, and west of the sixty-fifth meridian on 8 dates. Compared with the corresponding month of the last seven years the dates of occurrence of fog east of the fifty-fifth meridian numbered 4 more than the average; between the fifty-fifth and sixty-fifth meridians 3 less than the average; and west of the sixty-fifth meridian 3 less than the average.

TEMPERATURE OF THE AIR.

[*In degrees Fahrenheit.*]

The mean temperature is given for each station in Table II, for voluntary observers, but in Table I, for the regular stations of the Weather Bureau, both the mean temperatures and the departures from the normal are given for the current month.

The *monthly mean temperature* published in Table I, for the regular stations of the Weather Bureau, is the simple mean of all the daily maxima and minima; for voluntary stations a variety of methods of computation is necessarily allowed, as shown by the notes appended to Table II.

The distribution of the monthly mean temperature of the